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U. S. DEPARTMENT OF AGRICULTURE,
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L. O. HOWARD, Entomologist and Chief of Bureau.

MISCELLANEOUS PAPERS.

THE ORANGE THRIPS.

By DUDLEY MOULTON,
Engaged in Deciduous Fruit Insect Investigations.

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INTRODUCTORY.

The orange thrips, *Euthrips citri*, a new species, described in this article, has become a very important orange-tree pest in the southern San Joaquin Valley of California and has been the subject of special investigation. The writer has been able to talk with many orange growers and packers, and with men who have developed extensive nurseries, and the following notes have been gathered largely from these sources.

DISTRIBUTION.

The San Joaquin orange belt extends along the western border of the Sierra foothills from a point about east from the city of Fresno, southward to a short distance below Porterville, with some orchards as far south as Bakersfield. The belt is not at all continuous, but is broken in many places because of improper soil conditions, frosts, and the lack of water for irrigation. The thrips is distributed everywhere throughout this belt, but is not found, so far as I have been able to learn, in any other orange section of California.

EXTENT AND NATURE OF INJURY.

The orange groves in the San Joaquin belt are wonderfully profitable, for as much as $2,000 per acre has been realized in a single year from full-bearing orchards. This thrips problem is, therefore, a very important one when we consider the large area which is planted and is being planted.

Curled and thickened leaves and marked oranges, the characteristic signs of the thrips, have been known for from ten to fifteen years, but only recently have these injuries been attributed to the thrips. The thrips has been increasing rapidly in numbers, until now the annual loss to the orange growers amounts to many thousands of dollars.

The writer recently visited a packing house where oranges from thrips-infested orchards were being graded and boxed, and found that about 30 per cent were passed from fancy (first grade) to choice (second grade), which means a difference in price of about 40 cents per box; and that about 5 per cent of the crop was being passed out as culls, due entirely to the scablike markings of the thrips. While the quality of the fruit is not noticeably impaired, as the injury is present only on the surface of the skin, oranges are graded and also sold largely on appearance, and this scab produces a very unpresentable fruit. (See Pl. VIII, figs. 3, 4.)

The thrips feeds also on the foliage and tender branches, and the damage to these is serious, although not so noticeable as on the fruit. Only newly unfolding and tender leaves and buds are attacked; as the feeding is mostly confined to the surface no part of the leaf tissue is killed outright, but there follows the "silvering," characteristic of thrips and other surface-feeding insects. The leaves become cup-shaped and wrinkled and the tissues noticeably thickened. (Pl. VIII, figs. 1, 2.) Orange trees in this section have four growths annually, so that there is always an abundance of new foliage present when the thrips is above ground.

LIFE-HISTORY NOTES.

There are apparently two broods of this species. Adults of the first brood appear just before the blossoms in February, March, and April, and a second brood appears in July, August, September, and October. Adults and larvæ of the first brood feed on the small oranges just as the petals are being thrown off, the larvæ usually under the protection of the sepals, and on the first growths of the foliage. The second brood feeds on the nearly mature oranges and on the third and fourth growths of the foliage. All varieties of oranges and lemons are attacked, but the very noticeable scabbing on the fruit is common only on the navel orange; it is less conspicuous on the Valencia.

SOIL CONDITIONS AS AFFECTING PREVALENCE.

It has been noticed that the thrips is not so prevalent on trees planted in sedimentary or loam soils as where the soil is of a clayey or adobe texture. This fact may be explained as follows: This thrips, like most others of its group, presumably spends the last of its larval, its pupal, and its early adult life in the soil underneath the trees, and would naturally, then, be more or less affected by the texture of the soil and by cultivation. Orange groves are usually irrigated several times during the summer and are cultivated throughout the year. Sedimentary soils break to pieces readily

WORK OF THE ORANGE THRIPS (EUTHRIPS CITRI, N. SP.).

Fig. 1.—Injury to tender orange shoot. Fig. 2.—Orange buds in axils of leaves killed back as fast as formed, preventing further growth. Fig. 3.—Scab injury at stem end of orange, due to work of thrips shortly after blossoms fell. Fig. 4.—Scab injury at distal end of orange, due to work of thrips late in season. (Original.)

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when thus moistened and cultivated, and thrips in this ground would probably be broken from their small cells, if indeed they were able to make cells at all in this soil, and many of them would be killed by the cultivator and by the grinding together of the soil particles during cultivation. On the other hand, in clay lands the particles of soil pack closely together and form clods, and during cultivation any number of thrips within these clods might be repeatedly turned over and over without injury. In this soil, too, it would be possible for the thrips to make a strong, well-lined cell.

Another fact in the cultivation of orange groves should be mentioned in this connection. After the trees have become large and the fruit-laden limbs hang over and drag on the ground it seems impossible to cultivate thoroughly close up to the tree, and there may be an area of several square feet that is not disturbed during the entire summer. This offers an ideal breeding place for the thrips.

REMEDIES.

We are not able at this time to say what spray can be used to control this thrips, but a strong tobacco extract will doubtless prove effective and will not hurt the tree. Some of the cheaper soap washes ought also to be effective.

ENEMY.

It may be mentioned that a *Triphleps*, presumably *T. insidiosus* Say, is found everywhere feeding on the larvæ of this thrips.

DESCRIPTION.

The following description of the female of *E. citri* has been made after examination of many specimens. No males have yet been collected. The insect is called *citri* because, so far as we know, it feeds on citrus trees only.

Euthrips citri n. sp.

Measurements: Head, length 0.75 mm., width 0.15 mm.; prothorax, length 0.09 mm., width 0.18 mm.; mesothorax, width 0.24 mm.; abdomen, width 0.25 mm.; total body, length 0.86 mm. Antennæ: 1, 12μ; 2, 36μ; 3, 39μ; 4, 39μ; 5, 30μ; 6, 34μ; 7, 6μ; 8, 12μ; total, 0.205 mm. *Color*, yellow to orange-brown, with thorax and segment 2 of antennæ more noticeably orange-brown.

Head twice as wide as long, retracted considerably into the prothorax, broadly rounded in front, with only slight depressions to receive the basal joints of the antennæ; two spines on anterior margin, other spines not conspicuous; cheeks almost straight and parallel. *Eyes* large, occupying almost one-half the length of the head,

prominent; pigment deep red to purple; facets of eyes large, eyes pilose. Ocelli subapproximate, margined inwardly with yellow-brown crescents. *Mouth-cone* short, reaching almost to posterior margin of prothorax, broadly rounded and with black stop at tip; maxillary palpi 3-segmented. *Antennæ* 8-segmented, with segment 2 orange-yellow, other segments uniformly light brown; segments 2, 4, 5, 6 almost equal in length; style about one-half the length of segment 6. All spines inconspicuous; sense cones transparent.

Prothorax about twice as wide as long, posterior angles broadly rounded; with long brown and outer small spine at each posterior angle, other spines not conspicuous. *Mesothorax* largest and with anterior angles broadly rounded. *Legs* light yellow-brown, with tarsi lighter but dark brown at the tips; spines on legs brown. *Wings* present and fully developed, fore-wings broadest near base and pointed at tips; with a ring vein and a single longitudinal vein which divides at about one-third the length of the wing from the base, the anterior part running parallel and approximate to the anterior part of the ring vein and ending abruptly near the tip, the posterior paralleling and approaching the posterior part of the ring vein and ending about one-half the wing's length from the end, each branch with a dark-brown marking immediately at its tip. The costa bears a row of about 29 regularly placed spines. Other spines placed as follows: A group of 5 near base of median longitudinal vein; 2 on either side of where second vein branches from the first, and 3 scattered spines about equidistant on each branch vein and in each case one of these spines immediately at the end of the vein; several rather long spines on scale. Veins of the fore-wing unusually strong and conspicuous, somewhat orange colored near base but fading to yellow near tip. Membrane of wings transparent.

Abdomen ovoid, tip conical, all spines, excepting a very few at tip, inconspicuous.

Described from many female specimens collected from orange foliage and fruit at Exeter, Tulare County, Cal.

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